This article was downloaded by: [RMIT University] On: 30 August 2013, At: 06:07 Publisher: Taylor & Francis Informa Ltd Registered in England and Wales Registered Number: 1072954 Registered office: Mortimer House, 37-41 Mortimer Street, London W1T 3JH, UK



Synthetic Communications: An International Journal for Rapid Communication of Synthetic Organic Chemistry

Publication details, including instructions for authors and subscription information: <u>http://www.tandfonline.com/loi/lsyc20</u>

A Practical Procedure for the Solid-Phase Synthesis of Racemic 2,2'-Dihydroxy-1,1'binaphthyl

M. O. Rasmussen ^{a b} , O. Axelsson ^a & D. Tanner ^c

^a NeuroSearch, A/S, 26B Smedeland, DK-2600, Glostrup, Denmark

^b Dept. Of Life Sciences and Chemistry, University of Roskilde, DK-4000, Roskilde, Denmark

^c Dept. of Organic Chemistry, Technical University of Denmark, DK-2800, Lyngby, Denmark Published online: 22 Aug 2006.

To cite this article: M. O. Rasmussen , O. Axelsson & D. Tanner (1997) A Practical Procedure for the Solid-Phase Synthesis of Racemic 2,2[']-Dihydroxy-1,1[']-binaphthyl, Synthetic Communications: An International Journal for Rapid Communication of Synthetic Organic Chemistry, 27:23, 4027-4030, DOI: <u>10.1080/00397919708005446</u>

To link to this article: http://dx.doi.org/10.1080/00397919708005446

PLEASE SCROLL DOWN FOR ARTICLE

Taylor & Francis makes every effort to ensure the accuracy of all the information (the "Content") contained in the publications on our platform. However, Taylor & Francis, our agents, and our licensors make no representations or warranties whatsoever as to the accuracy, completeness,

or suitability for any purpose of the Content. Any opinions and views expressed in this publication are the opinions and views of the authors, and are not the views of or endorsed by Taylor & Francis. The accuracy of the Content should not be relied upon and should be independently verified with primary sources of information. Taylor and Francis shall not be liable for any losses, actions, claims, proceedings, demands, costs, expenses, damages, and other liabilities whatsoever or howsoever caused arising directly or indirectly in connection with, in relation to or arising out of the use of the Content.

This article may be used for research, teaching, and private study purposes. Any substantial or systematic reproduction, redistribution, reselling, loan, sub-licensing, systematic supply, or distribution in any form to anyone is expressly forbidden. Terms & Conditions of access and use can be found at http://www.tandfonline.com/page/terms-and-conditions

A PRACTICAL PROCEDURE FOR THE SOLID-PHASE SYNTHESIS OF RACEMIC 2,2'-DIHYDROXY-1,1'-BINAPHTHYL

M. O. Rasmussen,^{a,b} O. Axelsson^{*,a} and D. Tanner^c

^aNeuroSearch A/S, 26B Smedeland, DK-2600 Glostrup, Denmark. ^bDept. Of Life Sciences and Chemistry, University of Roskilde, DK-4000 Roskilde, Denmark, ^cDept. of Organic Chemistry, Technical University of Denmark, DK-2800 Lyngby, Denmark.

ABSTRACT: A high yielding solid-phase dimerisation of 2-naphthol by means of a ball-milling procedure is described.

Optically pure 2,2'-dihydroxy-1,1'-binaphthyl (1), usually obtained by resolution, has found widespread use as a chiral auxiliary or catalyst in enantioselective synthesis. The oxidative coupling of two molecules of 2-naphthol (2) to give race-

^{*}To whom correspondence should be adressed. Present address: Nycomed Innovation AB, Ideon Malmø,S-20512, Malmø,Sweden.

mic 1 has been effected by a number of methods and the reaction has been performed in solution as well as in the solid state.⁴⁻⁶



For example, a yield of 90% of 1 was obtained by coupling of 2 in dichloromethane solution using 1 mol % CuCl(OH)•TMEDA as catalyst.⁴ However, a disadvantage of this method is that the reaction must be carried out in rather dilute solutions. This problem can be overcome by running the reaction in tetrahydrofuran, but then the yield is significantly lower (60 %).⁵ A solid-phase synthesis of 1 gave a yield of 95%, but required heating of a finely powdered mixture of 2 and FeCl₃•6H₂O to 50°.⁶ Since we have found it difficult to control the heating of powders we here report an alternative and practical method for the solid-phase synthesis of racemic 1. The reaction is carried out in a ball-mill which simultaneously effects the intimate mixing of 2 and FeCl₃•6H₂O and gentle heating of the mixture. Solid sodium chloride is used as an additive to improve the mechanical properties of the reaction mixture. By this method, yields of 87% (recrystallized material) have been obtained, and a typical experimental procedure is given below.

Experimental

The NMR spectrum was recorded on a Bruker AM 500 MHz spectrometer with CDCl₃ as the solvent and chemical shifts are referenced to TMS. The mass spectrum was obtained on a JEOL JMS AX-505W double focusing mass spectrometer. The melting point was determined with a Griffin melting point apparatus. The ball milling procedure was performed in a Fritsch Planetary Micro Mill Pulverisette 7.

Procedure.- A mixture of **2** (1.0 g, 7.0 mmol), FeCl₃•6H₂O (3.8 g, 14.0 mmol) and NaCl (3.5 g) was ball-milled for 1 h and afterwards stirred 3 times with 100 ml of concentrated HCl, the last time overnight . The grey clay-like product was filtered off, washed with water until the washings where neutral and dried *in vacuo* to yield 0.98 g of crude product. Recrystallization from a mixture of ethanol and 0.1 M HCl (1:1) gave **1** (0.87 g, 87%) as a crystalline solid, mp. 213-216 °C, lit. mp. 216-218 °C. ^{4 1}H-NMR: δ 7.98 (d, J = 8.9, 2H), 7.90 (d, J = 8.0, 2H), 7.39 (d, J = 8.9, 2H), 7.38 (ddd, J = 8.0/7.0/1.2, 2H), 7.31 (ddd, J=8.5/7.0/1.3, 2H), 7.16 (d, J=8.4, 2H), 5.04 (Broad, -OH, 2H). MS (EI): m/e = 286 (M⁺).

REFERENCES

1: (a) For a number of applications and leading references, see: Noyori, R., "Catalysis in Organic Synthesis," Wiley, New York, 1994. (b) Noyori, R., Tomino, I., and Tanimoto, Y., J. Am. Chem. Soc., 1979, 101, 3129.

2: Rosini, C., Franzini, L., Raffaeli, A. and Salvadori, P., Synthesis, 1992, 503.

- 3: Mikami, K. and Matsukawa, S., Nature, 1997, 385, 613.
- 4: Noji, M., Nakajima, M. and Koga, K., Tetrahedron Lett. 1994, 35, 7983.
- 5: Deuβen, H.-J., Frederiksen, P., Bjørnholm, T. and Bechgaard, K., Org. Prep. Proc. Int., 1996, <u>28</u>, 484.
- 6: Toda, F., Tanaka, K. and Iwata, S., J. Org. Chem., 1989, 54, 3007.

(Received in The Netherlands 17 June 1997)